PATENT SPECIFICATION

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COMPLETE SPECIFICATION

DRAWINGS ATTACHED

Magnetic Separators

I, JEAN ULRICH THOMA, a German citizen of Rotfluhstrasse, 10, Zollicon, Zurich, Switzerland, do hereby declare the invention, for which I pray that a Patent may be granted to me and the method by which it is to be performed to be particularly described in and by the following statement:—

This invention relates to magnetic separators for the extraction of magnetizable foreign bodies from fluids such as lubricating oils, coolants etcetera of the kind having a magnetic element mounted within a casing through which the liquid is caused to flow.

The object of the present invention is a construction of casing which will control the flow of liquid between an inlet and an outlet so as to obtain a high degree of magnetic separation of impurities.

Broadly the present invention consists in a magnetic separator having a casing for a magnetic element, which comprises a tube of non-magnetic material adapted to surround the magnetic element so as to define an annular space around the magnetic element, said tube having groups of perforations at its ends separated by an intermediate imperforate portion and a casing surrounding the perforated tube so as to define an annular space around the perforated tube, said casing having an inlet and an outlet so that fluid may pass through the separator, said inlet being located opposite the imperforate portion of the perforated tube.

To enable the invention to be put into practice one practical embodiment will now be described, by way of example, by aid of the accompanying drawing which shows in sectional elevation an assembled magnetic separator according to the invention.

The magnetic separator shown in the drawing has a magnetic element according to my co-pending application No. 24541/57 (Serial No. 855,928) which is in the form of a cylindrical candle comprising a thin walled brass or other non-magnetic tube 1 of equal diameter throughout its length which is closed at both ends and serves to enclose a series of cylindrical permanent magnets 2 arranged in superimposition with like poles opposing each other and separated by metal pole pieces 3. The permanent magnets 2 are a loose fit in the tube 1 so as to leave an air gap 4 between the magnets and the inside wall of the tube, and the pole pieces 3 are an interference fit or made to fit closely within the tube so as to leave no air gap or as small an air gap as possible between the pole pieces and the tube. The magnets and pole pieces are held in close end to end contact with each other by any suitable means, such, for example, as a distance piece 5 within the upper end of the tube 1 which is pressed against the upper pole piece in the assembly.

The above candle is suspended from the cover plate of an outer casing 6 and within a perforated tube 7 of non-magnetizable material. The internal diameter of this tube is substantially greater than the outside diameter of the inner imperforate brass tube so as to leave a wide annular space to constitute the sedimentation chamber.

A further annular space 8 is provided around the perforated tube 7 and between the same and the outer casing 6, said space being divided into lower and upper compartments by a diaphragm in the form of an annular washer 9 which extends radially across the space from the outside of the perforated tube to the inside of the casing. The dirty fluid enters the lower compartment through an inlet 10 in the wall of the casing 6 and the cleaned fluid passes out of the upper compartment through an inlet 11, also in the wall of the casing 6.

[Price 3s. 6d.]

In its passage from the inlet to the outlet, the fluid is forced to flow through the holes in the wall of the perforated tube into the sedimentation chamber and out again through the holes in the wall of the perforated tube after having flowed over the exterior surface of the magnetic candle. For this purpose the group of holes are located at the end regions of the tube 7 and are separated by a middle imperforate portion. The groups of holes are indicated generally in the drawing by the reference numeral 12. Whilst the fluid is thus moving through the sedimentation chamber metal impurities are attracted to the exterior of the inner brass tube in the regions of the enclosed pole pieces 3 and such impurities, when sufficient has accumulated, may easily be wiped off, either by freeing the cover plate and withdrawing the candle or by manipulating a scraper, not shown, situated within the sedimentation chamber.

As an optional feature but having the tendency to increase the efficiency of the separator the exterior of the magnetic candle is provided with longitudinal guide ribs 13 to cause the direction of flow of the fluid to be axial and not circumferential.

In the preferred embodiment described above the fluid enters and leaves the sedimentation chamber through holes in the perforated tube 7. Other means not shown, may, however, be provided for this purpose such, for example, as an inlet through the wall of the tube near its lower end and an outlet through the wall of the tube near its upper end.

When the magnetic separator of the present invention is to be used with fluid having a considerable amount of suspended impurities it is an advantage to be able to scrape the exterior of the candle without removing the candle and therefore relieving the fluid pressure. This may be effected by providing a scraper in the form of a ring adapted to be moved up and down within the sedimentation chamber from the exterior of the outer casing and in scraping contact with the brass tube of the magnetic candle. The collected impurities will thereby be caused to fall into a suitable compartment at the base of the sedimentation chamber. Where the guide ribs 13 are used on the exterior of the candle suitable clearance slots will have to be provided in the scraper ring. Instead of a scraper ring other means may be provided capable of performing a similar function.

In the example illustrated the pole pieces 3 are in the form of circular metal discs each having a continuous or unbroken peripheral edge. Alternatively however the continuity of the edge of each disc may be broken at intervals by gaps.

This results in a series of separated surfaces of relatively small area in contact with the inside surface of the enclosing tube 1. It is thought that the resulting concentration of magnetic field intensity at each separated area of the tube thus contacted gives a more efficient separation than is provided by the pole pieces having continuous peripheral edges.

The air gaps 4 between the permanent magnets 2 and the tube 1 may be completely or partly filled by one or more pieces of non-magnetic material such as cardboard, plastic, brass etcetera, but preferably single pieces of such material in the form of sleeves. These serve to centralise the permanent magnets in relation to the axis of the tube 1.

The magnetic element herein described and illustrated forms the subject matter of my co-pending Application No. 24541 57 (Serial No. 855928) and no claim is made herein to anything claimed in the complete specification of said co-pending application.

WHAT I CLAIM IS:—

1. A magnetic separator having a casing for a magnetic element, which comprises a tube of non-magnetizable material adapted to surround the magnetic element so as to define an annular space around the magnetic element, said tube having groups of perforations at its ends separated by an intermediate imperforate portion, and a casing surrounding the perforated tube so as to define an annular space around the perforated tube, said casing having an inlet and an outlet so that liquid may pass through the separator, said inlet being located opposite the imperforate portion.

2. A magnetic separator comprising in combination a tube of non-magnetizable material having groups of perforations in the end regions of the tube separated by an intermediate imperforate portion, a magnetic element in the form of a cylindrical candle supported within the perforated tube the diameter of which is substantially greater than the diameter of the cylindrical candle so as to provide a wide intervening annular space to constitute a sedimentation chamber, an outer casing surrounding the perforated tube in spaced relationship to provide a further annular space therebetween, and a diaphragm serving to divide said further annular space into two compartments into one of which compartments the dirty fluid is introduced through an inlet and from the other compartment the treated fluid is removed through an outlet, said fluid in passing from the inlet to the outlet being constrained to flow through one group of perforations, over the outer surface of the cylindrical candle and out through the other group of perforations.

3. A magnetic separator as in claim 2 wherein the annular space between the per-

forated tube and the outer casing is divided into upper and lower compartments by means of a radial diaphragm.

4. A magnetic separator according to the example herein described and illustrated.

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PROVISIONAL SPECIFICATION

Magnetic Separators

I, JEAN ULRICH THOMA, a German citizen of Rotfluhstrasse 10, Zollikon, Zurich, Switzerland, do hereby declare this invention to be described in the following statement:—

This invention relates to magnetic separators of the kind in which permanent magnets are used to provide the magnetic attraction for the extraction of impurities from fluids such as lubricating oils, coolants etcetera.

The object of the present invention is to provide an efficient magnetic separator which can easily be cleaned.

Broadly the present invention consists in a magnetic separator of the kind which comprises a series of permanent magnets arranged with like poles opposite each other and separated by pole pieces, and enclosed in a tube of non-magnetic material, said pole pieces having a diameter which enables them to fit closely against the wall of the tube so as to reduce the air gap to a minimum and the permanent magnets having a diameter which is preferably less than and never greater than the diameter of the pole pieces.

A magnetic separator according to one practical embodiment of the invention has a magnetic element in the form of a cylindrical candle comprising a brass or other non-magnetic tube closed at both ends and serving to enclose a series of cylindrical permanent magnets arranged in superimposition with like poles opposing each other and separated by metal pole pieces. The permanent magnets are a loose fit in the tube so as to leave an air gap between the magnets and the inside wall of the tube, and the pole pieces are made to fit closely within the tube so as to leave as small an air gap as possible between the pole pieces and the tube. The magnets and pole pieces are held in close end contact with each other by any suitable means.

The above candle is suspended from the cover plate of a casing within a perforated outer tube of non-magnetizable material. The internal diameter of this outer tube is substantially greater than the outside diameter of the inner imperforate brass tube so as to leave a wide annular space to constitute the sedimentation chamber.

A further annular space is provided around the perforated tube and between the same and the outer casing, said space being divided into lower and upper compartments by a diaphragm in the form of an annular washer which extends radially across the space from the outside of the perforated tube to the inside of the casing. The dirty fluid enters the lower compartment through an inlet in the wall of the casing and the cleaned fluid passes out of the upper compartment through an outlet, also in the wall of the casing.

In its passage from the inlet to the outlet, the fluid is forced to flow through the holes in the wall of the perforated tube into the sedimentation chamber and out again through the holes in the wall of the perforated tube after having flowed over the exterior surface of the magnetic candle. Whilst the fluid is thus moving through the sedimentation chamber metal impurities are attracted to the exterior of the inner brass tube in the regions of the enclosed pole pieces and such impurities, when sufficient has accumulated, may easily be wiped off, either by freeing the cover plate and withdrawing the candle or by manipulating a scraper situated within the sedimentation chamber.

As an optional feature but having the tendency to increase the efficiency of the separator the exterior of the magnetic candle may be provided with longitudinal guide ribs to cause the direction of flow of the fluid to be axial and not circumferential.

In the preferred embodiment described above the fluid enters and leaves the sedimentation chamber through holes in a perforated tube. Other means may, however, be provided for this purpose such for example, as an inlet through the wall of the tube near its lower end and an outlet through the wall of the tube near its upper end.

When the magnetic separator of the present invention is to be used with fluid having a considerable amount of suspended impurities it is an advantage to be able to scrape the exterior of the candle without removing the candle and therefore relieving the fluid pressure. This may be effected by providing a scraper in the form of a ring adapted to be moved up and down within the sedimentation chamber from the exterior of the outer casing and in scraping contact with the brass tube of the magnetic candle. The collected impurities will thereby be caused to fall into a suitable compartment at the base of the sedimentation

chamber. Where guide ribs are used on the exterior of the candle suitable clearance slots will have to be provided in the scraper ring. Instead of a scraper ring other means may be provided capable of performing a similar function.

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855,929 COMPLETE SPECIFICATION

1 SHEET

This drawing is a reproduction of the Original on a reduced scale.